

Maternal Mortality and Morbidity Review in Massachusetts

A Bulletin for Health Care Professionals

Pregnancy-Associated Mortality: Medical Causes of Death, 1995-1998

Purpose

The purpose of this bulletin is to present Massachusetts-specific data related to maternal causes of death and maternal mortality ratios from 1995 through 1998, summarize case review findings, and suggest strategies for improving maternal outcomes. This bulletin covers deaths from medical causes associated with pregnancy (see page 2 for definitions). Future bulletins will address other causes of maternal deaths (e.g. drug overdose, homicide and other injuries), and additional epidemiological mortality and morbidity analyses.

Background

A maternal death is a sentinel event. During the last half of this century we have witnessed a dramatic decrease in maternal mortality in Massachusetts. Earlier work¹ documents a decline from 50 per 100,000 live births in the early 1950s to 10 per 100,000 live births in 1985. During those same years, leading causes of maternal death shifted from infection, cardiac disease, pregnancy-induced hypertension and hemorrhage to injury (i.e., suicides, homicides and motor vehicle accidents) and pulmonary embolism.² According to the National Center for Health Statistics, Massachusetts has the second lowest maternal mortality ratio in the U.S (3.3/100,000).³ These unfortunate deaths teach important lessons to help prevent future mortality. They also provide clues for understanding maternal morbidity and improving women's health in general.

In 1997, the Commissioner of the Massachusetts Department of Public Health (MDPH) appointed a Maternal Mortality and Morbidity Review Committee (MMMRC) to review maternal deaths, study the incidence of pregnancy complications, and make recommendations to improve maternal outcomes and prevent mortality. The work of the committee is protected under M.G.L. c.111, section 24A and 24B, which assures the confidentiality of all records and proceedings.⁴ The committee consists of obstetricians, certified nurse midwives, maternal fetal medicine specialists, a neonatologist and a pathologist (see Appendix A). This initiative follows the tradition of improving maternal health through case review begun by the Committee on Maternal Welfare of the Massachusetts Medical Society in 1941. That effort was chaired by Dr. John F. Jewett from 1953 to 1985.⁵ Over time, definitions of maternal death have evolved and case finding methods have improved, but the goal of promoting maternal health has remained unchanged.

Defining a Maternal Death

There is no standard definition of maternal mortality with respect to causes of death or timing of death in relation to pregnancy. Varying definitions used at state,⁶ national and international levels make comparisons of mortality ratios across states and with national data quite difficult (see Appendix B for definitions). For example, the World Health Organization (WHO) and the National Center for Health Statistics (NCHS) define maternal deaths as occurring either during pregnancy or within 42 days after pregnancy termination. Individual states, however, have adopted various time intervals, from a minimum of 42 days to a maximum of 18 months postpartum. The WHO recently added a second category, called late maternal death, which includes deaths occurring between 42 and 365 days following the end of pregnancy. Deaths caused by accidental or incidental causes or from cancer are excluded under many definitions. The MMMRC purposely chose a broad definition of maternal mortality to permit the most thorough retrospective investigation possible.

Definition of Maternal Death Used in this Study

For the purposes of this investigation, the definition of maternal mortality recommended by the Maternal Mortality Study Group, a national group jointly chaired by the Division of Reproductive Health at the Centers for Diseases Control and Prevention (CDC) and the American College of Obstetricians and Gynecologists (ACOG), was used.⁷ In accordance with that definition, the term “**pregnancy-associated**” is used instead of “**maternal**” to reflect the inclusion of deaths occurring during pregnancy.

Pregnancy-associated death: The death of a woman while pregnant or within one year of termination of pregnancy, irrespective of cause.

Pregnancy-associated deaths are divided into three categories:

1. **Pregnancy-related.** The death of a woman while pregnant or within one year of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by her pregnancy or its management, but not from accidental or incidental causes .⁸
2. **Pregnancy-associated-but-not-pregnancy-related.** The death of a woman while pregnant or within one year of termination of pregnancy due to a cause unrelated to pregnancy.
3. **Undetermined if pregnancy-related.** The death of a woman while pregnant or within one year of termination of pregnancy, but the relationship of her death to pregnancy cannot be determined.

The MMMRC further categorized deaths into those deaths that were caused by a medical condition, and deaths caused by intentional or unintentional injury.

Pregnancy-Related Death:

If this woman had not been pregnant, would she have died?

Mandatory Reporting of Maternal Deaths

Massachusetts hospitals are obligated to report to the MDPH's Division of Health Care Quality the death of any woman during pregnancy or within 90 days of delivery or termination, regardless of the cause of her death. This regulation applies to deaths that occur in a hospital setting.

Submit reports by telephone or Fax:

Telephone: **617-753-8150**

Fax: **617-753-8165**

The Massachusetts Department of Public Health requires that “the death of a pregnant woman during any stage of gestation, labor or delivery or the death of a woman within 90 days of delivery or termination of pregnancy will be reported within 48 hours to the department by the hospital in which the death occurs [105 CMR 130.628(C)].” 1989

Methods

Case Finding

Pregnancy-associated deaths occurring in Massachusetts from 1995 through 1998 were identified through mandatory facility reporting to the MDPH Division of Health Care Quality, and manual and automated reviews of death certificates. In addition to these traditional case-finding methods, the MMMRC employed an enhanced surveillance method linking birth certificates and fetal death certificates to death certificates of reproductive-age women. This approach has also been adopted by other states. These enhanced and improved surveillance methods in combination with the ACOG/CDC definition identified more deaths than previously reported.

Case Review

All available hospital medical records related to each woman's pregnancy and death, as well as her death certificate and certificates of infant birth or fetal death were obtained. A primary and secondary reviewer from the MMMRC analyzed all available documents and summarized each case for the entire committee without identifying patients, clinicians, or institutions. In addition, medical specialists in oncology, neurology and infectious disease were asked to review specific cases. During reviews, consensus was sought on answers to several questions:

- Was the death pregnancy-related?
- Was the death preventable?
- What public health and/or clinical strategies might prevent future deaths?

A **“preventable death”** is broadly defined as a death that may have been averted by one or more changes in the health care system related to clinical care, facility infrastructure, public health infrastructure and/or patient factors.

Reviews were limited to attainable records, and the following medical records and documents were not reviewed by the committee: ambulatory care records not part of the hospital medical records; full reports of autopsies conducted by state medical examiners; hospital records for births or fetal deaths occurring outside of Massachusetts; and information about deaths or births occurring in non-hospital settings. These records may have provided additional insight.

Mortality Ratios, Causes, and Timing of Death⁹

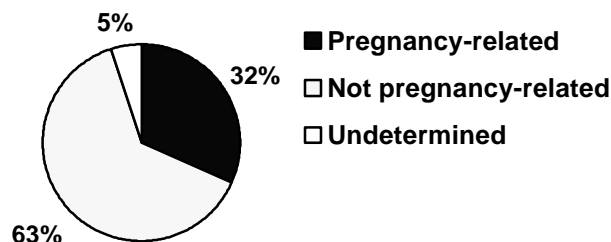
From 1995 through 1998, 88 women were identified (using the enhanced surveillance methods) who met the definition of a pregnancy-associated death. Three additional women were identified and their cases reviewed, but their deaths occurred more than one year following pregnancy and were therefore excluded from this analysis.¹⁰ Of the 88 deaths, 60 (68%) were caused by medical conditions, i.e. were not the result of an injury or drug overdose. The remaining 28 deaths were caused by intentional or unintentional injuries and will be reviewed and reported on in the future.

Pregnancy-Associated Mortality Ratios¹¹

Year	Mortality (All Causes)	
	N	Ratio
1995	21	25.4
1996	19	23.4
1997	25	30.8
1998	23	28.0
Total	88	26.9

Using the enhanced case finding methodology, the pregnancy-associated mortality ratio over the four-year period was 26.9 per 100,000 live births. Among the 60 deaths caused by medical conditions, the pregnancy-related mortality ratio was 5.8/100,000, and the pregnancy associated but not pregnancy-related mortality ratio was 1.6/100,000 (data not shown). These ratios cannot be compared to other publications due to differences in definitions and case finding methodology.

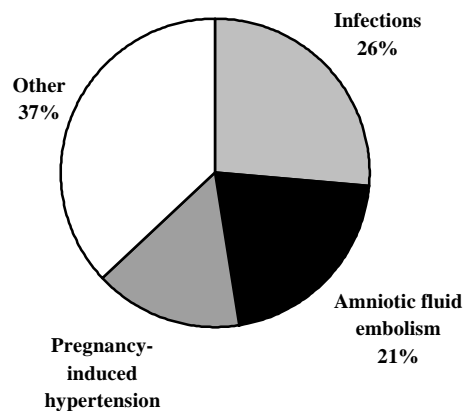
Distribution of Maternal Deaths Caused by Medical Conditions



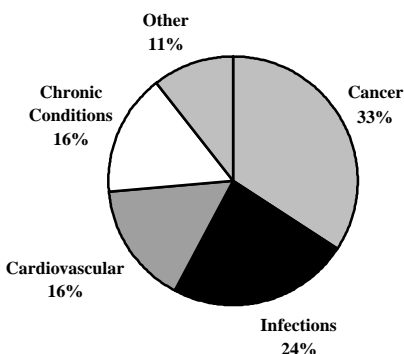
Among the deaths caused by medical conditions, 19 (32%) were pregnancy-related, 38 (63%) were not related to pregnancy, and in 3 (5%) cases it could not be determined whether or not the deaths were related to pregnancy based on available evidence.

Distribution of Pregnancy-Related Medical Causes of Death

The leading medical cause of pregnancy-related death was infectious disease (26%), followed by amniotic fluid embolism (21%) and pregnancy-induced hypertension (16%). Infectious diseases included septicemia, sepsis and varicella. Pregnancy-induced hypertension included HELLP syndrome (Hemolysis, Elevated Liver enzymes, and Low Platelets) and eclampsia. Other causes included cerebrovascular, cardiovascular and chronic conditions, and anesthetic complications.



Pregnancy-associated but not pregnancy-related medical causes of death



The leading cause of pregnancy-associated but not pregnancy-related deaths was cancer (33%) followed by infectious diseases (24%), cardiovascular (16%) and chronic conditions (16%). Cancer deaths included melanoma, lymphoma, leukemia, brain tumors and other rare cancers. Two women had pre-existing diagnoses of cancer before they became pregnant. Infectious diseases included HIV, meningitis, encephalitis, pneumonia, and sepsis. Chronic conditions included asthma, diabetes, lupus and seizure disorders. Other causes included cerebrovascular and iatrogenic conditions.

Timing of Medical Causes of Death

Thirty percent (n=18) of the deaths occurred either during pregnancy or within one week postpartum. Almost all (94.8%) of the pregnancy-related deaths and one-third (34.2%) of the deaths not related to pregnancy occurred within 42 days postpartum, a time coinciding with close contact with obstetrical providers.

Number of Days	All		Related		Not Related		Undetermined	
	N	%	N	%	N	%	N	%
<7 days	18	30.0	14	73.7	3	7.9	1	33.3
7-41 days	15	25.0	4	21.1	10	26.3	1	33.3
42-89 days	7	11.7	0	0.0	7	18.4	0	0.0
90-364 days	20	33.3	1	5.3	18	47.4	1	33.3
Total	60	100.0	19	100.0	38	100.0	3	100.0

Preventable Deaths

A "preventable death" is broadly defined as a death that may have been averted by one or more changes in the health care system related to clinical care, facility infrastructure, public health infrastructure and/or patient factors. These determinations were made with the benefit of retrospective review and current clinical practice guidelines at the time of the review rather than at the time of the death.

Overall, 30% of the deaths (n=18) may have been preventable. Among the pregnancy-related deaths, 42% (n=8) may have been preventable, and among the deaths not related to pregnancy 26% may have been preventable (n=10). The preventability of 9 deaths (15%) could not be determined from the information available at the time of review, and 33 deaths (55%) were probably not preventable.

STRATEGIES TO SAFEGUARD MATERNAL HEALTH

Maternal death case reviews provided meaningful information about when, how and why women died while pregnant or during the first year after the end of their pregnancy. Although infrequent, preventable deaths teach valuable lessons to avert future severe morbidity and deaths. Using composite case scenarios to provide a context for the reader, this section suggests strategies to safeguard maternal health for clinicians, hospital and ambulatory care facilities, as well as the entire public health community. These recommendations are intended to stimulate discussion among all those interested in improving maternal health and pregnancy outcomes and do not represent a comprehensive approach.

Scenarios are composite vignettes drawn from two or more cases with key information changed to protect the identities of patients and providers.

Strategies for Clinicians

Varicella

Scenario: *A 30y/o woman with no known history of varicella was counseled to avoid exposure during pregnancy. She had an uneventful labor and delivery. In the postpartum period she was exposed and became symptomatic with varicella. Medical records did not indicate if she contacted her provider or was offered VZIG. She became acutely ill, was hospitalized and eventually died of disseminated varicella.*

History of varicella. All pregnant women should be asked about their history of childhood diseases including varicella. History of varicella is an excellent indication of immunity.

Counseling. Pregnant and postpartum women without evidence of varicella infection by history or seropositivity should be counseled to avoid contact with persons with chickenpox or shingles. In addition, these susceptible women should be instructed to call their obstetrical provider soon after any varicella exposure during pregnancy and postpartum periods. Susceptible pregnant women should be counseled to receive their first dose of varicella vaccine in the postpartum period

Varicella Prevention:

- **VZIG for pregnant and postpartum women.** Susceptible pregnant women who are exposed to varicella infection should be given varicella zoster immune globulin (VZIG) within 96 hours of exposure. Given the short time frame for administration of VZIG after exposure, verifying seronegativity may not be possible. VZIG may be given at any time during pregnancy and is free to all MA residents (see Appendix C). Postpartum women have the option of receiving VZIG or varicella vaccine for prophylaxis.
- **VZIG for infants.** Infants whose mothers had an onset of varicella symptoms within five days before delivery and up to 48 hours after delivery, should also receive VZIG.
- **Varicella vaccine.** Susceptible non-pregnant women of childbearing age should be offered varicella vaccine (two doses administered four weeks apart). Pregnancy should be avoided for one month following each dose of vaccine. In lieu of VZIG, varicella vaccine can also be given to susceptible non-pregnant women, including postpartum women, within 72 hours after exposure to varicella infection.
- **Report varicella vaccine use in pregnancy.** If varicella vaccine is inadvertently given within one month of pregnancy, the likelihood of untoward effect is considered to be extremely small. All such cases should be reported to the VARIVAX Pregnancy Registry (see Appendix C).

Influenza

Scenario: *A 35 y/o woman, G2P1, delivered an infant without complications. Several days after her delivery she developed a flu-like syndrome. Approximately one week later the patient developed adult respiratory distress syndrome secondary to multilobar pneumococcal pneumonia. Her condition worsened rapidly and she never recovered. Final cause of death was pneumococcal pneumonia superimposed on viral infection. Influenza A infection was confirmed.*

Influenza vaccine. Recent evaluation of published data suggests that an average of 1-2 hospitalizations per 1,000 pregnant women could be prevented in each average influenza season by immunizing pregnant women." The Advisory Committee on Immunization Practices (ACIP) of the Centers for Disease Control and Prevention (CDC) recommends routine influenza immunization of women who will be in the second or third trimester of pregnancy during influenza season. Pregnant women with medical conditions that increase their risk of complications from influenza should be vaccinated regardless of stage of pregnancy. Immunization during pregnancy with the inactivated vaccine is considered safe by many experts, however some providers prefer not to administer the vaccine during the first trimester to avoid association with spontaneous abortion that might occur coincidentally (see Appendix C).

Pneumococcal vaccine. Current American College of Obstetricians and Gynecologists and ACIP/CDC recommendations state that women with high risk conditions for pneumococcal disease (e.g., lung disease, asthma, asplenia) be vaccinated, preferably before pregnancy. If an unvaccinated, high-risk woman becomes pregnant, some authorities in the field advise deferring immunization until after the first trimester (see Appendix C).

HIV Infection

Scenario: *A 25 y/o pregnant woman with HIV infection presented with dyspnea and a CD4 count of 14 in her last trimester. She was diagnosed with *Pneumocystis carinii* pneumonia and started on treatment. She went into labor and delivered a viable preterm infant. Her respiratory condition never improved and she eventually died of complications. Although this patient had been receiving HIV care of unknown frequency from an infectious disease specialist, her obstetrical provider was unaware of the HIV status or any HIV-related treatment she was receiving.*

Counseling and testing. After counseling about HIV infection, providers should recommend and offer HIV antibody testing to all pregnant women and all women considering pregnancy.

Treatment. The medical treatment goal for HIV-infected women, pregnant or not, is to maintain optimal health of the woman. All HIV-infected pregnant women who are in care should be offered antiretroviral therapy. Treatment decisions should consider both the pregnant woman's well being and the prevention of vertical transmission to her infant.

Coordination of care between obstetrical and HIV provider. HIV treatment is more successful but far more complex given the variety of pharmacologic regimes available. It is important that a provider with experience in the management of HIV be directly involved in the woman's care. This means that an HIV-infected woman should be receiving care from both an obstetrical provider and an HIV specialist during pregnancy and the postpartum period. Care should be provided in a collaborative manner to maximize the health of the mother and minimize risks to the fetus and baby.

Case Management. Patients with HIV infection who may have difficulty adhering to a treatment regimen or have other complex issues should be referred for case management services.

Septicemia

Scenario: A 22 y/o G2P1 in her second trimester developed a fever over 103°F without focal signs or symptoms. Cultures were taken and the patient was sent home. Her condition worsened and she presented at the emergency department where fetal demise was diagnosed. She deteriorated rapidly with onset of septic shock. Her underlying cause of death was determined to be beta-hemolytic Group A streptococcal sepsis.

Treatment. A woman in the peripartum who shows signs of septicemia should be treated with broad-spectrum antibiotics and screened for disseminated intravascular coagulopathy (DIC). Empiric antibiotic treatment should begin before the final determination of a pathogen. Group A beta-hemolytic *Streptococcus pyogenes* is a very rare cause of puerperal infection in the present era, however it can still cause maternal death. *Strep. pyogenes* can produce an exotoxin that can cause a toxic shock-like syndrome and/or DIC. This pathogen can also present as bacteria with or without symptoms and as an upper respiratory tract infection.

Septic Shock. In cases of fetal demise, prompt diagnosis and treatment of septic shock and DIC are required.

Pregnancy Induced Hypertension (PIH)

Scenario: A 36 y/o G1PO was admitted at 34 weeks in early labor with a diagnosis of PIH (B/P144/94, +4 proteinuria and +4 reflexes). She was induced and delivered without complications. After delivery the patient's blood pressure continued to be elevated and she complained of epigastric pain and nausea. Her lab values were consistent with HELLP. Treatment included magnesium sulfate and monitoring on a regular postpartum floor. Approximately 40 hours after delivery she had multiple grand mal seizures. Her condition deteriorated and she never recovered. Postmortem findings were consistent with eclampsia with DIC.

Management. HELLP, including immediate postpartum cases, should be managed aggressively. If the patient's condition worsens she should be transferred to a unit with a high staff to patient ratio. The ACOG Technical Bulletin of Hypertension in Pregnancy reviews methods and techniques of practice for obstetrical providers (see Appendix C).

Chronic Conditions

Scenario: A 35 y/o G1PO had a documented history of cardiac arrhythmia which was controlled by medication. When she became pregnant, she discontinued her medication without consulting a cardiologist. Two months postpartum the patient had palpitations, collapsed suddenly and could not be resuscitated by the EMTs.

Co-management of chronic illness. If a patient gives a history of a chronic or life threatening illness, confirm that she is receiving the appropriate primary and consultant care during pregnancy and postpartum.

Non-adherence to medication regimen. Obstetrical providers should monitor patients' adherence to chronic medication regimes. Appropriate medical consultation should be obtained if a patient has independently discontinued taking a medication for a potentially life threatening condition.

Eating Disorders

Scenario: A 34 y/o G4P2 with a past history of bulimia had a pregnancy and birth without complications. Five weeks postpartum she collapsed and was admitted in a coma. She never regained consciousness. Apparently she had been purging daily to reduce her weight.

Screening and Referral. Women with histories of eating disorders are at risk for an exacerbation of this problem during the prenatal and postpartum periods. All pregnant and postpartum women should be screened for eating disorders and referred as appropriate.

Strategies for Hospital and Ambulatory Care Facilities

Anesthesia and Analgesics

Scenario: A 35 y/o G4P2 had a difficult labor and delivered by cesarean section. She received various analgesics through epidural, IV and IM routes during labor and delivery, in the recovery room, and on the postpartum floor. Her care was managed by several providers and through different shifts of nursing staff. No system was in place to track the cumulative amount of narcotics administered.

Monitoring. The administration of analgesics should be monitored closely for cumulative amount, particularly for women whose care is managed by multiple providers (e.g. anesthesia, obstetrics).

Care of Critically Ill Patients

Scenario: A 33 y/o G3P2 with a postpartum wound infection, developed shortness of breath, chest pain and respiratory arrest. She was resuscitated but needed mechanical ventilation. The patient was transferred to an intensive care unit, but needed isolation because of her wound infection. When her respirator malfunctioned, no staff were available to assist her.

Policies and Procedures

- Existing policies requiring minimum staffing levels for critically ill patients and protocols for monitoring life-support equipment should be followed.
- Emergency equipment and procedures should be reviewed on a regular, established schedule.
- Guidelines should be established for oversight of the care of critically ill obstetrical patients by senior medical staff.
- If the need for more intensive obstetrical and neonatal care is anticipated, the patient should be transferred to a hospital with an appropriate level of care.

Documentation

Scenario: A 43 y/o Spanish-speaking G8PO with a history of infertility had a cerclage placed early in pregnancy. At 27 weeks she began bleeding and had signs of infection. She refused removal of the cerclage to preserve her pregnancy and subsequently developed septicemia and died. Medical records did not indicate that an interpreter was provided or that she understood the risks she was taking in refusing treatment.

When applicable the following information should be recorded in each patient's record:

- Written informed patient consent or non-consent for services or treatment, particularly when patient decisions may negatively effect patient's life and outcome of pregnancy.
- Offer and receipt of social services.
- Explicit chronology during emergencies or during the care of critically ill patients.
- Use of translation and interpreter services.
- Prenatal care record in obstetrical inpatient record after the third trimester.

Strategies for the Public Health Community

Access

Scenario: A 38 y/o G3P2 non-English speaking Hispanic woman was enrolled in Healthy Start during her pregnancy. Several months postpartum she developed nausea and vomiting and eventually became non-responsive. When she arrived at the emergency department she was comatose with severe diabetic ketoacidosis and never recovered. Staff had difficulty communicating with family members and could not determine if she had seen a primary care provider since she had given birth

Translation Services

- Hospital and other health care facilities should provide medical interpreter services for non-English speaking patients.
- According to MDPH regulation 105 CMR:130 615(c), health education materials and activities shall be available in the languages of any non-English speaking group which comprises at least 10% of the population served by the maternal-newborn services.

Transition from Obstetrical to Primary Care:

- All patients, including those patients enrolled in Healthy Start or the uncompensated care pool, should be referred to a primary care provider after obstetrical care is completed.
- Outreach services for the Healthy Start program should expand to the postpartum period to assist women in accessing ongoing primary care.

Preconception care

- Public health professionals and clinicians working with women of child-bearing age should offer information about family planning services, early signs of pregnancy, warning signs of miscarriage and associated sepsis, and the importance of seeking early prenatal care.
- Public health professionals and clinicians working with women of child-bearing age with chronic or life threatening conditions should provide pre-conception counseling about the impact of pregnancy on her health, the impact of her condition on pregnancy, and options available for family planning.

Skin Cancer

Scenario: A 25y/o G2P1 delivered a healthy infant without complications. Two months postpartum she was diagnosed with metastatic malignant melanoma. She had neglected to tell her prenatal provider that she had had a bleeding lesion on her scalp for at least 6 months.

Periodic Screening. All women should be encouraged to have a complete skin exam, including the scalp, by a specially trained health care provider, beginning as early as age 20. In families with a history of melanoma, screening should begin between ages 12 and 14. The American Cancer Society recommends a cancer-related checkup, including skin examination, every three years for people between 20 and 40 years of age, and every year for anyone age 40 and older.

Cardiovascular Disease

Scenario: *After successfully quitting during her pregnancy, a 42 y/o G3P3 resumed smoking a pack of cigarettes per day after delivery. She had been complaining of “bad indigestion” for a couple of days when she suffered a fatal heart attack at her workplace.*

Screening and Education

- Screen all patients with a history of smoking for relapse or continued smoking postpartum. Counsel and refer for cessation as needed.
- Health education programs in schools and anticipatory guidance in all patient age groups by primary care clinicians should include prevention strategies for cancer and cardiovascular disease.

Conclusions

Maternal death, while rare, is a critical health indicator for women giving birth in the Commonwealth. Improved and expanded case-finding methods used in this study facilitated the identification of more deaths than previously noted and demonstrate the importance of expert case review in conjunction with an active maternal mortality surveillance system. The review of medical causes of maternal death suggests that some of these deaths may have been prevented. Lessons learned from these deaths can enhance the development of a comprehensive strategy to improve women's health at clinical, institutional and community levels.

Notes and References

1. Sachs B, Brown D, Driscoll S, et al. Maternal Mortality in Massachusetts - Trends and Prevention. *The New England Journal of Medicine* 1987; 316:667-672.
2. Sachs BP, Brown DA, Driscoll SG, et al. Hemorrhage, infection, toxemia, and cardiac disease, 1954-85: causes for their declining role in maternal mortality. *Am J Public Health* 1988; 78:671-5.
3. NCCDPHP, CDC. State-specific maternal mortality among black and white women - United States, 1987-1996. *MMWR* 1999; 48:492-496.
4. All appointed members of the committee and assigned DPH staff also signed a confidentiality pledge as a prerequisite to their participation in this effort.
5. Jewett JF. Changing maternal mortality in Massachusetts. *The New England Journal of Medicine* 1957; 256:395-400.
6. Atrash HK, Lawson HW, Ellerbrock TV, Rowley DL, Koonin LM. Pregnancy-Related Mortality. In: Wilcox LS, Marks JS, eds. *From Data to Action: CDC's Public Health Surveillance for Women, Infants, and Children*. Washington, DC: U.S. Department of Health and Human Services/CDC, 1995:141-154.
7. Atrash H, Rowley D, Hogue C. Maternal and perinatal mortality. *Curr Opin Obstet Gynecol* 1992; 4:61-71.
8. This definition differs from ICD-10 which uses the term "pregnancy related" to refer to a death from any cause during or within 42 days of the end of pregnancy (see Appendix B).
9. Massachusetts rates are not comparable to those of other states due to variations in definitions and case finding methodology.
10. Two deaths were caused by postpartum cardiomyopathy and occurred two and a half and seven years postpartum. The third death occurred 365 days post partum from a cause unrelated to pregnancy.
11. Deaths per 100,000 live births that occurred in Massachusetts.
12. "G" is for Gravida or total number of pregnancies, and "P" is for Para or total number of live births.
13. Neuzil K, Reed G, Mitchell E, Griffin M. Influenza-associated morbidity and mortality in young and middle-aged women. *JAMA* 1999; 281:901-907.
14. Healthy Start is a state sponsored prenatal care program for uninsured low income women not eligible for Medicaid.
15. World Health Organization. *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death*. 9th Revision, WHO, Geneva, (1977), and World Health Organization. *International Classification of Diseases and Related Health Problems*, 10th Revision, WHO, Geneva, (1992)

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Appendix A: Committee Members & Staff

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Appendix B: Other Definitions of Maternal Death

1. World Health Organization (WHO), International Classification of Diseases, Ninth Revision (ICD-9) and Tenth Revision (ICD-10):¹⁵

Maternal death:

The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.

Two additional definitions have been added to ICD-10:

Late maternal death:

The death of a woman from direct or indirect obstetric causes more than 42 days but less than 1 year after the termination of pregnancy.

Pregnancy-related death:

The death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of the death.

2. National Center for Health Statistics (NCHS):

Deaths that occur during pregnancy or within 42 days after pregnancy termination, regardless of pregnancy duration and site, from any cause related to or aggravated by the pregnancy, but not from accidental or incidental causes.

3. Other state maternal mortality review efforts:

A number of other states have conducted maternal mortality reviews. Definitions of maternal death vary by time interval from the end of pregnancy until death, and causes of death. All state definitions include deaths that occur during pregnancy. However, the interval of time between the end of pregnancy and death varies from a minimum of 42 days to a maximum of 18 months. Some states, similar to Massachusetts, consider all causes of maternal deaths occurring within a specified time period, while other states restrict their definitions to pregnancy-related deaths only. Deaths from injuries and cancer often are omitted from review because they are considered to be non-pregnancy-related. Variation in definitions, case inclusion and exclusion criteria, and case finding methods, results in mortality ratios that are not comparable across states.

Appendix C: List of Resources

Infectious Disease:

Telephone numbers

- Varicella zoster immune globulin (VZIG): For information about obtaining free VZIG call 617-522-3700
- VARIVAX Pregnancy Registry (1-800-986-8999). All cases of varicella vaccine given while pregnant or within four weeks before pregnancy should be reported to the registry.
- HIV testing number 1-800-750-2016 (consumer)
- HIV information and counseling number 1-800-235-2331 (consumer)

Recommendations

- U.S. Public Health Service Task Force. "Recommendations for the Use of Antiretroviral Drugs in Pregnant Women Infected with HIV-1 for Maternal Health and for Reducing Perinatal HIV-1 Transmission in the United States". MMWR 1998, Jan 30; 47(RR-2): 1-30. Guidelines updated in 2000 are available in PDF and HTML format at <http://www.hivatis.org/trtgdlns.html#Perinatal>
- General recommendations on immunization: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1994; 43 (RR-1).
- Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1996; 45 (RR-11).
- Prevention of varicella updated: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999; 48(RR-06).
- Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 1999; 48(RR-04).

All immunization recommendations are available at <http://www2.cdc.gov/mmwr/>

Management of PIH:

ACOG Technical Bulletin of Hypertension in Pregnancy, Number 219, January 1996

Translation and Interpreter Services:

A listing of qualified vendors of translation and interpreter services that contract with various state entities may be found on the Commonwealth of Massachusetts website: <http://www.comm-PASS.com>

Search the site using the following criteria:

Document Type: closed

Purchasing Entity: *Operational Services Division*

Product Category: *Professional Services*

Keyword: *translation*

Select Foreign Language Written Translation & Oral Interpretation Services, Reference No: ST8J51 1; Contractor Contact Listing with Language, Rate and Zone Information.